Kline's Island Sewer System (KISS): Act 537 Planning

Overview of KIWWTP Peak Wet Weather & "High-Rate Treatment" Pilot Proposal

Presented to:

Lehigh County Authority

Board of Directors

November 14, 2022

11/14/22 Agenda

- BRIEF REVIEW OF EXISTING KIWWTP PEAK WET WEATHER CAPABILITIES
- BRIEF REVIEW OF THE PROPOSED PHASE 1 AND PHASE 2 PEAK WET WEATHER PROJECTS
- DISCUSS PROPOSED PILOT PROPOSAL (PHASE 3)

KIWWTP:

Peak Wet Weather work since 2020

Evaluation of Increase in Peak Flow Capacity

- Kleinfelder, October 2020

High-Rate Treatment Bench-Scale Testing

- AECOM, July 2021 and January 2022

Wet-Weather Treatment System Concept Design Memo

- Kleinfelder, May 2022

Capacity Problem Definition

- Arcadis, September 2022

Common Improvements Cost Memorandum

- Kleinfelder, October 2022

Existing KIWWTP Peak Wet Weather Capabilities

- **Conveyance System → limited hydraulically to 105 MGD**
  - Under current conditions, no more than 105 MGD can get to KIWWTP
  - Peak flows above 105 MGD back up in the interceptors or overflow from upstream manholes
- **KIWWTP Peak Pumping Capacity → limited to 87 MGD**
  - Outfall 003 used to discharge excess peak flows between 87 and 105 MGD to the Little Lehigh Creek, to protect the plant

BYPASS DATE	OUTFALL NUMBER	BYPASS: REASON FOR BYPASS	BYPASS: DURATION Hrs:Min	BYPASS: TOTAL VOLUME
4/7/2022	003	Hydraulic Capacity Exceeded	4:50	0.369
09/01/21	003	Hydraulic Capacity Exceeded - Ida	4:30	1.485
03/27/21	003	Human Error - Bar Screens	0:04	0.000024
12/25/20	003	Hydraulic Capacity Exceeded	0:43	0.00001
11/30/20	003	Hydraulic Capacity Exceeded	2:20	0.143127
11/09/20	003	PLC Failure	0:05	0.001
08/04/20	003	Hydraulic Capacity Exceeded	19:50	9.145
05/25/20	003	Power Outage	0:35	0.1163
04/29/19	003	Power Outage - Contractor Error	0:06	0.0039
11/02/18	003	Hydraulic Capacity Exceeded	5:50	3.389
08/22/18	003	Hydraulic Capacity Exceeded	2:08	0.3407
08/13/18	003	Hydraulic Capacity Exceeded	5:30	1.025
08/04/18	003	Mechanical Problem - Pumps & Hydraulic Capacity Exceeded	13:00	9.22
2017		No Bypasses		
02/24/16	003	Mechanical Problem - Pumps & Hydraulic Capacity Exceeded	7.75	1.181
2015		No Bypasses		
10/29/14	003	Mechanical Problem - Bar Screens	0.58	0.0072
04/30/14	003	Mechanical Problem - Bar Screens & Hydraulic Capacity Exceeded	11.33	1.17
2013		No Bypasses		
08/05/12	003	Power Outage - Severe Thunderstorm	0.17	0.0144
09/06/11	003	Hydraulic Capacity Exceeded - Lee	23.50	2.09
08/28/11	003	Hydraulic Capacity Exceeded - Irene	19.25	4.66
08/13/11	003	Mechanical Problem - Pumps	1.17	0.40

BYPASS DATE	OUTFALL NUMBER	REASON FOR BYPASS	DURATION Hrs:Min	TOTAL VOLUME
2009		No Bypasses		
12/12/08	003	Mechanical Problem - No.5 Aux. Pump	1.73	0.04
02/13/08	003	Hydraulic Capacity Exceeded	8.48	0.74
2007		No Bypasses		
06/28/06	003	Hydraulic Capacity Exceeded	11.57	2.81
06/26/06	003	Mechanical Problem - Bar Screens	2.50	0.40
10/08/05	003	Hydraulic Capacity Exceeded - Tammy	17.43	6.18
04/02/05	003	Hydraulic Capacity Exceeded	17.02	2.73
03/28/05	003	Hydraulic Capacity Exceeded	1.93	0.078
11/28/04	003	Hydraulic Capacity Exceeded	8.95	1.91
09/18/04	003	Hydraulic Capacity Exceeded - Ivan	7.90	2.76
07/12/04	003	Hydraulic Capacity Exceeded	4.12	0.75
09/15/03	003	Hydraulic Capacity Exceeded - Henri	4.38	0.36
07/21/03	003	Mechanical Problem - Bar Screens	3.97	0.46
06/21/03	003	Hydraulic Capacity Exceeded	17.08	2.49

History of Outfall 003 Bypasses *(2003-2022)*

Preliminary KIWWTP Wet-Weather Improvements

Phase 1 – Increase KIWWTP capacity from 87 to 100 MGD

Phase 2 – Increase KIWWTP capacity from 100 to 120 MGD

Phase 1:
87 to 100 MGD

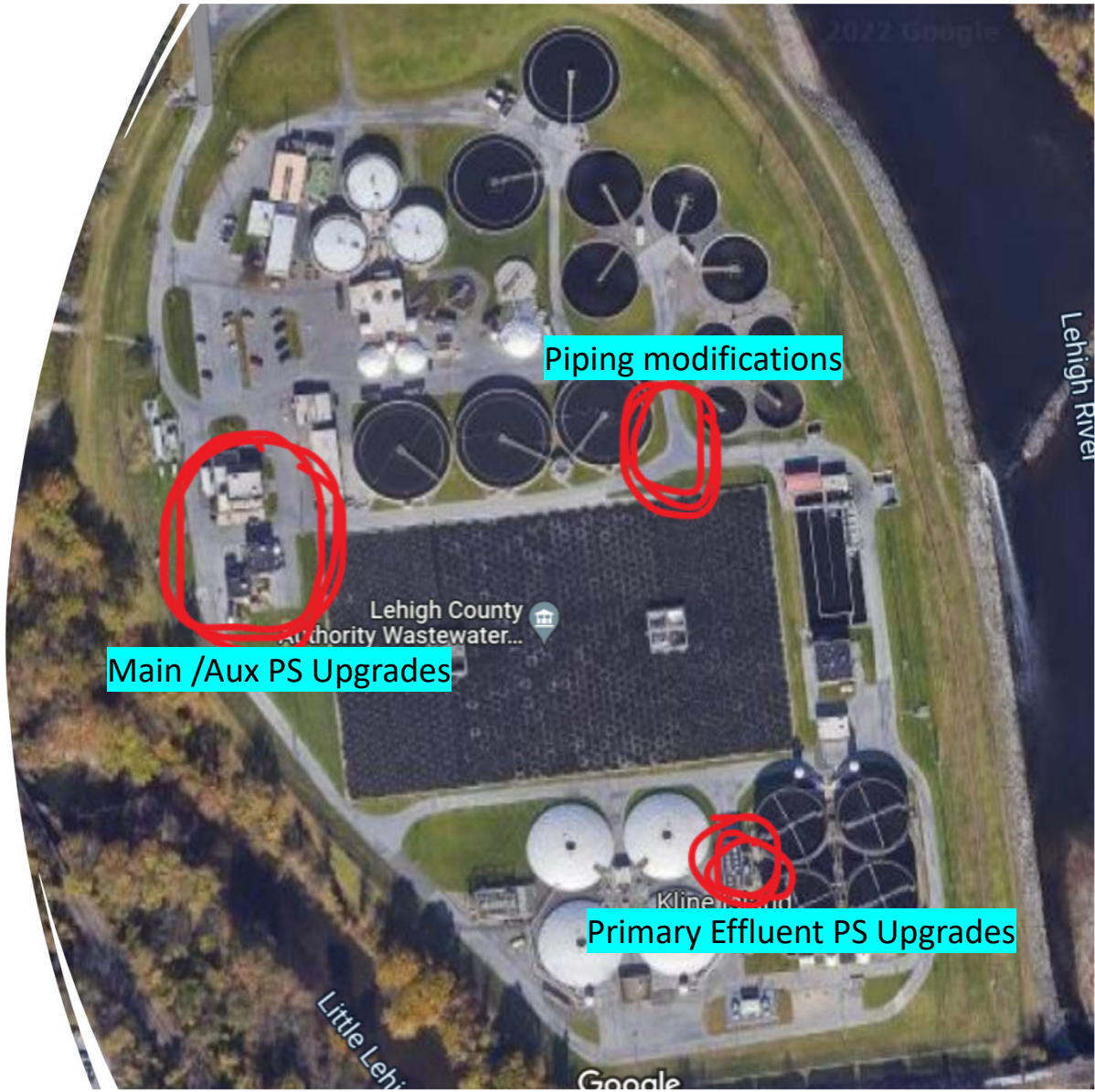
Master Plan driven projects (replacement of aging equipment & pumps)

What is needed?

- Increase influent pumping capacity →100 MGD
- Increase the capacity of the primary clarifier effluent pumps → 100 MGD
- Construct piping and valving → route 50 MGD from the Plastic Media Trickling Filters to the Final Clarifiers (also needed for Phase 2)

Phase 1:

Three main areas of construction



Phase 2:
100 to 120 MGD

Parallel biological treatment mode during peak events

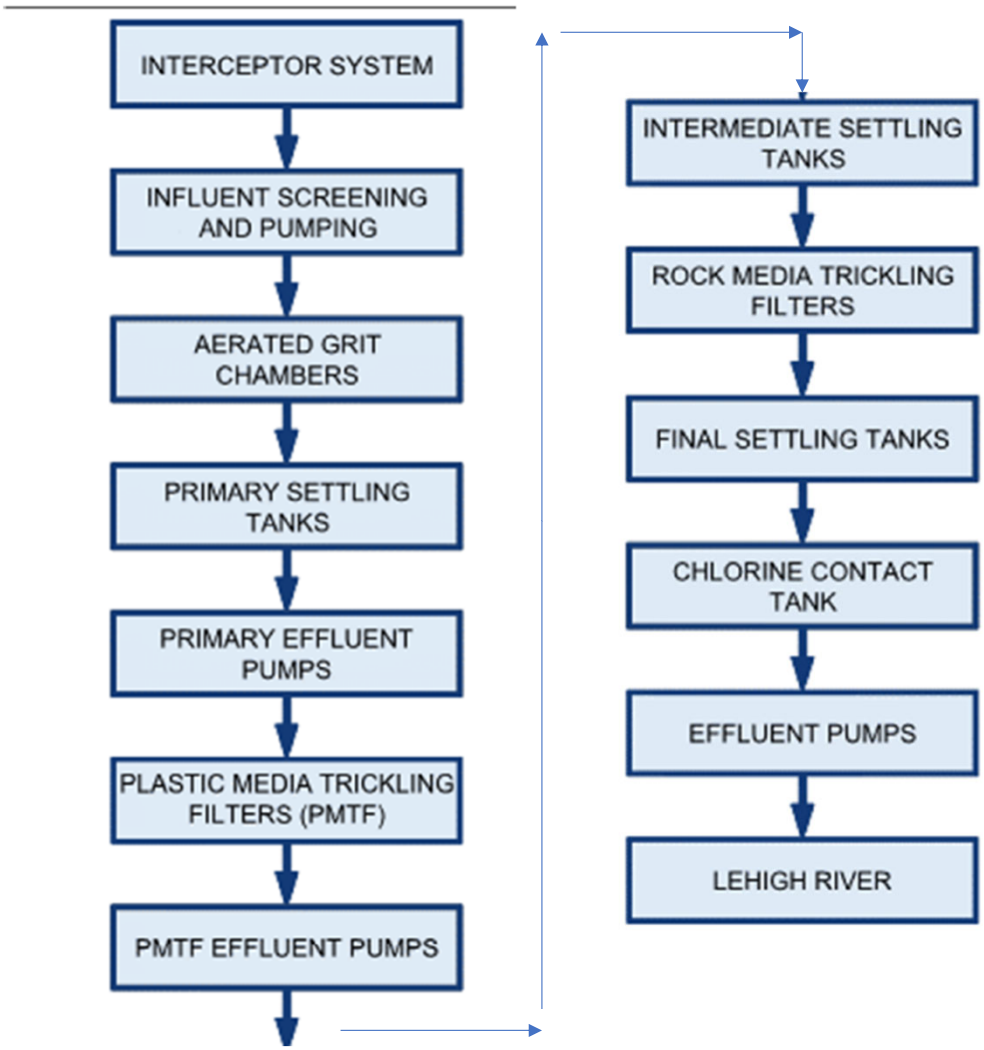
Key Features & Considerations:

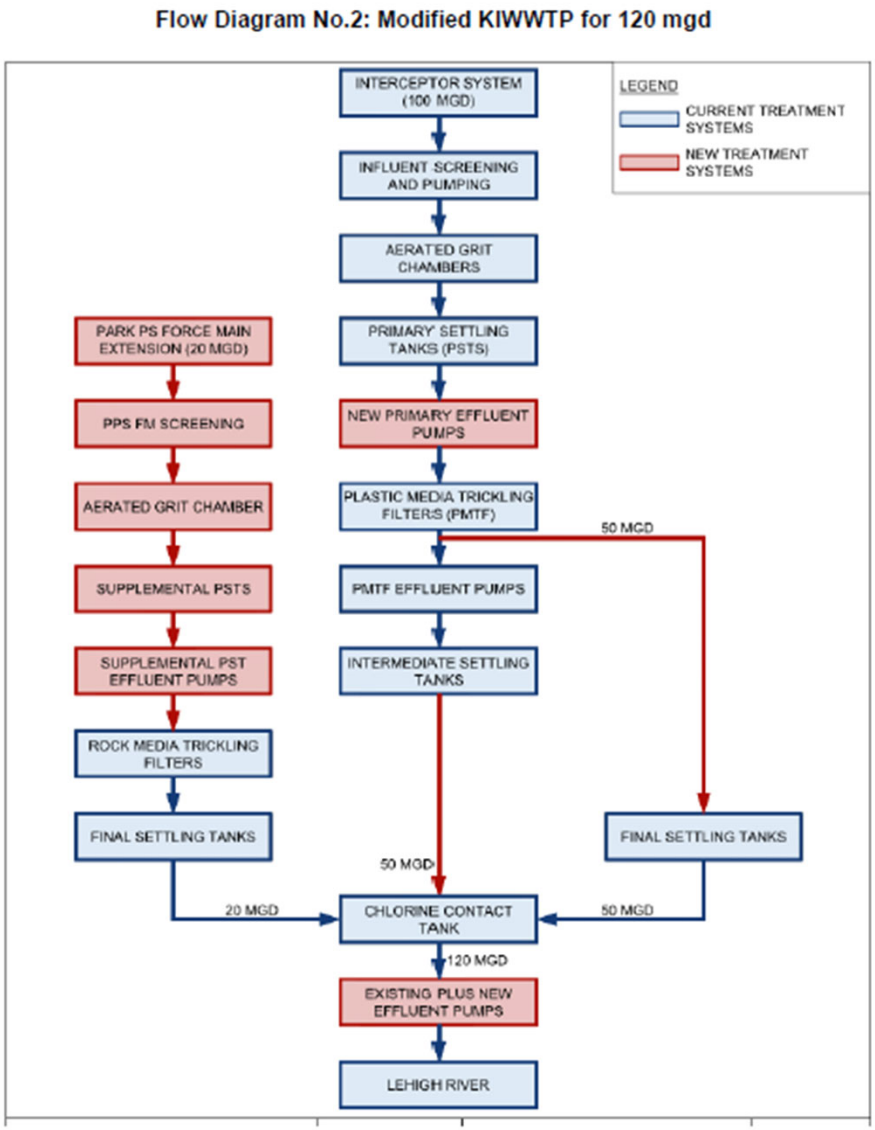
- Park Pump Station (capacity of 20 MGD) currently pumps to City interceptor approximately 1,000 feet upstream of KIWWTP
- Extending force main an additional 1,000 feet to KIWWTP will increase regional conveyance capacity to 120 MGD
- Phase 1 improvements (87-100 MGD) cannot be extended to 120 MGD
- “Parallel” operation to treat 100-120 MGD is acceptable to DEP

Existing KIWWTP Liquid Stream Schematic

All treatment occurs in sequence

Flow Diagram No.1: Existing KIWWTP





Proposed KIWWTP Liquid Stream Schematic

Peak flows up to 120 MGD treated in parallel

Phase 2:
100 to 120 MGD

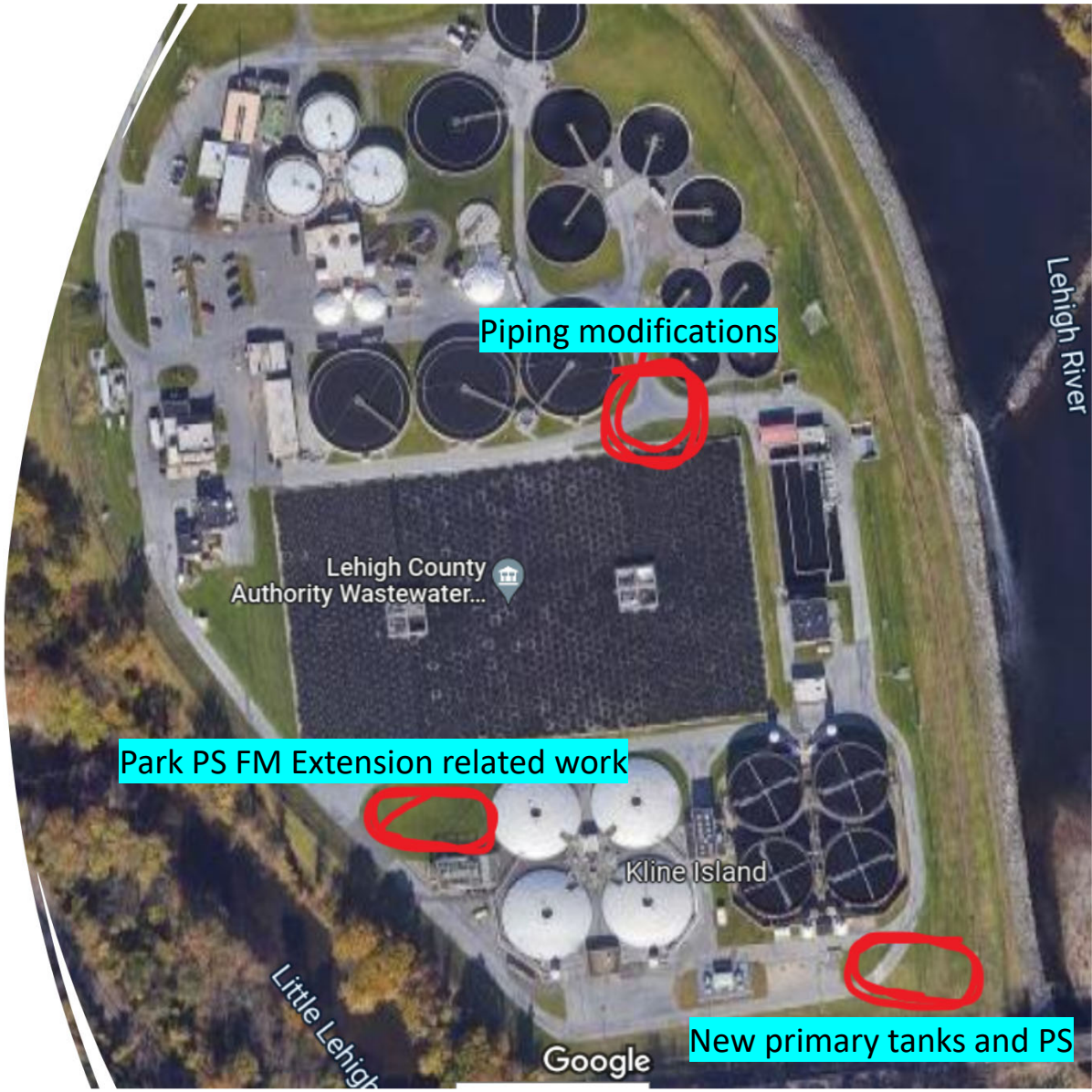
Parallel biological treatment mode during peak events

What is needed?

- Park Pump Station Force Main extension
  - *New screening system for the 20 MGD of flow from the extension*
  - *One additional aerated grit chamber*
- Two supplemental primary settling tanks
  - *20 MGD supplemental primary effluent pumping station (no solids removal)*
- Increase capacity of effluent pumping system to 120 MGD
- Additional piping and valving modifications

Phase 2:

Three main areas of construction



Status of Phase 1 & Phase 2 KIWWTP Wet-Weather Improvements

Pa. Department of Environmental Protection

- Review in June, August, and November 2022
- Comfortable Phase 1 and Phase 2 can be permitted

Delaware River Basin Commission

- Review in October 2022
- Comfortable Phase 1 and Phase 2 will meet definition of “no substantial alteration”

Design & Construction

- Preliminary design for Phase 1 under way
- Phase 1 to be constructed by 2026
- Phase 2 to be included in KISS Act 537 Plan for design & construction by 2028
- More detailed project review, including cost estimates, to be presented at future LCA meetings

Stop for Questions?

Up Next: Phase 3 Proposal

Phase 3:
> 120 MGD

Strategies and Timing

Arcadis flow modeling will define how much peak flow could reach KIWWTP in the planning period, depending on:

- Removing hydraulic restrictions in the conveyance system to allow peak flows to enter KIWWTP
  - Additional pumping & force mains
  - Parallel interceptors
- Aggressiveness and effectiveness of the municipalities' I&I programs

Options under consideration

- Equalization (EQ) tank(s)
- Expansion of the parallel treatment to be implemented in Phase 2
- **High-rate treatment (BioActiflo™)**

BioActiflo™ Piloting Driver

Not clear how far the parallel mode can be stretched, but likely will be < 150 MGD

Modeling underway:

Best current estimate

160 -180 MGD

EQ is conventional;

BioActiflo™ is an innovative alternative

Previous estimate: ~$9M savings in favor of 20 MGD BioAcitflo™ vs. equivalent EQ volume

Full savings potentially over $20 million (vs. equivalent EQ volume)

Piloting will allow for a refined design & cost evaluation

Current Proposal:

High-Rate Treatment Pilot (AECOM and Veolia)

Introduction:

- BioActiflo™ DEP approved
- Innovative – trickling filters
- Bench tests (3) 2021
- Proof of Concept

Objectives:

- Size Equipment
- Refine basis of design

Scope of Work:

- AECOM Oversight
- Veolia Proposal (demonstration unit and support)
- Detailed on next slides

Deliverables:

- AECOM = draft report; final report, workshop
- Veolia = Summary of operational results

Schedule:

- April – May 2023 = pilot length, June – July 2023 = final report delivery

Budget estimate:

- PSA (AECOM) = $141,750
- PSA (Veolia) = $98,000
- CPA = $264,750

AECOM Tasks 1-3:

Piloting Test Plan Development/Preparation Coordination/Operation and Sampling

In conjunction with Veolia + LCA/City...

- Develop a Pilot Test Plan
- Tests and analyses to be conducted:
  - Initial TSS concentrations
  - Total and soluble BOD, cBOD, final TSS

Coordination between Veolia and KIWWTP staff...

- Preparation for arrival of equipment
- Coordination between Veolia supplied items vs. KIWWTP supplied items

Operating the pilot...

- AECOM to provide personnel to observe/record data/assist as needed on a weekly basis
- Analytical and travel costs
- Veolia's operator costs are included in their proposal

AECOM Tasks 4-6:

Data Analysis/Meetings and Final Report/Project Management

Upon availability of analytical data...

- Compile data, review results, prepare a PowerPoint
- Prepare a draft report and revised cost estimate

Multiple meetings needed...

- Kick-off, draft pilot test plan review, mid-course review, draft findings review
- Draft Final Report review

General PM services...

- Quality control, project team coordination, client communications, billings

Pilot Schedule

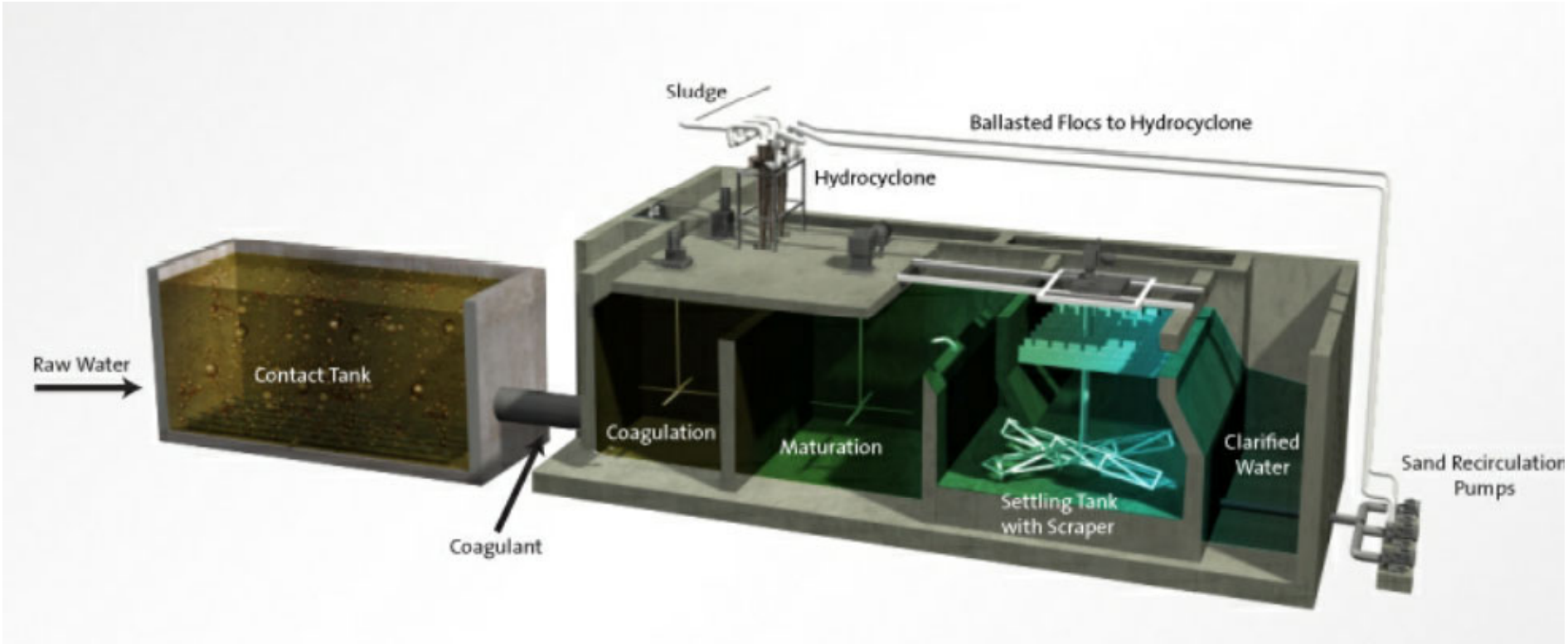
(April – May 2023)

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Pilot Unit Arrival & Setup			Setup/ Optimization	
Week 2	Optimization				
Week 3	Optimization / Extended Runs				
Week 4	Extended Runs				
Week 5	Extended Runs				
Week 6	Extended Runs			Pilot Decommission	

Total pilot cost includes two extra weeks (total of eight) as a contingency; costs reduced accordingly if not needed

VEOLIA BioActiflo™ Piloting Facility

BioActiflo™ 3-D Layout (typical)



Why pilot BioActiflo now?

- Preliminary reviews indicate significant cost savings for BioActiflo over more conventional approaches (flow equalization tanks)
- Pilot test results will be available when Preliminary Screening of Alternatives (PSOA) is nearing completion (spring 2023)
- Pilot results can be incorporated into PSOA before beginning the final alternatives analysis (2023-2024)
- Pilot program needed for DEP permitting, if BioActiflo is selected as a final alternative for the Act 537 Plan

Questions?